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Signed K Behan

Dated 29 April 2003

GB 0207390.6

By virtue of a direction given under Section 30 of the Patents Act 1977, the application is proceeding in the name of

SHANE ENGINES LIMITED,
Hatchgate Farm,
Plough Lane,
Bramshill,
Nr Hook,
Hampshire,
RG27 0JX,
United Kingdom

Incorporated in the United Kingdom,

[ADP No. 08465304001]

Patents Form 1/77

Patents Act 1977
(Rule 16)

The Patent Office

1/77

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THE PATENT OFFICE
K
28 MAR 2002
LONDON

Request for grant of a patent

The Patent Office

Cardiff Road
Newport
Gwent NP9 1RH

1.	Your reference	GCL/8261
2.	Patent application number *(The Patent Office will fill in this p*	0207390.6
		28 MAR 2002
3.	Full name, address and postcode of the or of each applicant *(underline all surnames)*	HUMPHRIES, Robin Hatchgate Farm Plough Lane Bramshill Nr. Hook Hampshire RG27 0JX
	Patents ADP number *(if you know it)*	8553487000
	If the applicant is a corporate body, give the country/state of its incorporation	
4.	Title of the invention	A mechanism including a piston-and-cylinder assembly
5.	Name of your agent *(if you have one)* "Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*	Abel & Imray 20 Red Lion Street London WC1R 4PQ
	Patents ADP number *(if you know it)*	174001

SECTION 30 (1977 ACT) APPLICATION FILED 16/9/02

		Country	Priority application number *(if you know it)*	Date of filing *(day/month/year)*
6.	If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number			

		Number of earlier application	Date of filing *(day/month/year)*
7.	If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application		

8.	Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:* *a) any applicant named in part 3 is not an inventor, or* *b) there is an inventor who is not named as an applicant, or* *c) any named applicant is a corporate body.*	No

9. Enter the number of sheets for any of the following items you are filing with this form.
Do not count copies of the same document.

Continuation sheets of this form	None
Description	9
Claim(s)	5
Abstract	None
Drawing(s)	3 + 3

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	1
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature
Abel & Imray

Date
28 March 2002

12. Name and daytime telephone number of person to contact in the United Kingdom

Mr G Leila 0207 242 9984

A mechanism including a piston-and-cylinder assembly

The invention relates to a mechanism including a piston-and-cylinder assembly.

The invention provides a mechanism including:

a piston-and-cylinder assembly including a piston housed in a cylinder,

a pin member passing through the piston and

a guide member having a guide slot accommodating an end of the pin member,

the guide slot being so shaped and orientated in relation to the piston-and-cylinder assembly that a common axis exists between the guide slot and the piston-and-cylinder assembly,

the guide member and the piston-and-cylinder assembly being so mounted as to be rotatable relative to each other about the common axis and

the guide slot being so shaped as to guide the pin member in a continuous curve, causing the piston to sweep up and down the cylinder, when the guide member and the piston-and-cylinder assembly rotate relative to each other.

Preferably, the mechanism includes axial slots in the cylinder, the pin member engaging the axial slots and, preferably, the axial slots lie on a diameter of the cylinder.

An aspect of the invention is the provision of a mechanism including:

a piston-and-cylinder assembly including a first piston housed in a first cylinder and a second piston housed in a second cylinder,

a first pin member passing through the first piston and a second pin member passing through the second piston and

a guide member having a guide slot accommodating an end of the first pin member and an end of the second pin member,

the guide slot being so shaped and orientated in relation to the piston-and-cylinder assembly that a common axis exists between the guide slot and the piston-and-cylinder assembly,

the guide member and the piston-and-cylinder assembly being so mounted as to be rotatable relative to each other about the common axis and

the guide slot being so shaped as to guide the pin members in a continuous curve, causing the first and second piston to sweep up and down the cylinder, when the guide member and the piston-and-cylinder assembly rotate relative to each other.

Preferably, the form of the piston-and-cylinder assembly permits the first and second cylinders to lie diametrically opposed to each other.

Preferably, the mechanism includes at least one further pair of diametrically opposed cylinders on the piston-and-cylinder assembly,

further pistons in the further cylinders and

further pin members passing through the pistons and being accommodated in the guide slot.

Preferably, the guide slot is of a rhomboid shape with curved corners and, preferably, the curved corners are parts of ellipses.

Alternatively, the guide slot is elliptical in shape.

As another alternative, the guide slot includes three parts which are elliptical in shape and a fourth part which

is substantially straight, the straight part occupying a position corresponding to the expansion stroke of the piston or pistons.

Preferably, the mechanism includes a second guide member having a second guide slot accommodating the other end of the pin member or the other ends of the pin members, the second guide slot being so shaped and orientated in relation to the piston-and-cylinder assembly as to share the common axis existing between the first guide slot and the piston-and-cylinder assembly

Preferably, the mechanism includes axial slots in the cylinders, the pin members engaging the axial slots and, preferably, the axial slots lie on diameters of the cylinders.

In one arrangement, the common axis is the axis of a shaft on which the piston-and-cylinder assembly is rotatably mounted, the remainder of the mechanism being fixed.

In another arrangement, the common axis is the axis of a shaft on which the guide member is rotatably mounted or the guide members are rotatably mounted, the piston-and-cylinder assembly being fixed.

Ina further arrangement, the guide member is or the guide members are rotatably mounted on the shaft and so is the piston-and-cylinder assembly.

A mechanism in accordance with the invention may be included in a heat engine, wherein the pistons and cylinders are pistons and cylinders of the heat engine and, in operation, generate motive power for the mechanism.

Preferably, the heat engine is an internal combustion engine.

The heat engine may be a Diesel-cycle engine or, alternatively, an Otto-cycle engine.

A mechanism in accordance with the invention will now be described by way of example only with reference to the accompanying drawings in which:

Fig. 1 represents a front view of the mechanism showing a guide slot of a guide member accommodating six pin members and a piston-and-cylinder assembly having six cylinders rotatably mounted on a shaft,

Fig. 2 represents a front view of a guide member having a guide slot accommodating four pin members,

Fig. 3 represents a front view of a piston-and-cylinder assembly showing details of a cylinder of a four-cylinder arrangement and

Fig. 4 represents a side view of the piston-and-cylinder assembly of Fig. 3.

Referring to Fig. 1 of the accompanying drawings, the mechanism includes a piston-and-cylinder assembly including a disc-shaped carrier member 1 on which are mounted six cylinders 2 to 7 housing six pistons 8 to 13. Six pin members 14 to 19 pass diametrically through the pistons 8 to 13 and one set of the ends of the pin members 14 to 19 are accommodated in a guide slot having peripheries 20, 21 in a guide member (not shown). The piston-and-cylinder assembly and the guide slot have a common axis 22. The piston-and-cylinder assembly is mounted on a shaft 23 the axis of which is the common axis 22. The piston-and-cylinder assembly is attached to the shaft 23 and is rotatable about the common axis 22.

Although not shown in Fig. 1, the mechanism includes a second guide slot in a second guide member for accommodating the other set of the ends of the pin members 14 to 19, the guide slots being of the same shape.

The six cylinders 2 to 7 are evenly spaced around the disc-shaped carrier member 1, their axes being 60 degrees apart. The peripheries 20, 21 of the guide slot are of a rhomboid shape with curved corners resulting in a guide slot which is of a rhomboid shape with curved corners. The curved corners of the guide slot are parts of ellipses and the guide slot is relatively straight between the curved corners.

In the operation of the mechanism shown in Fig. 1, the piston-and-cylinder assembly rotates about the common axis 22 and the pin members 14 to 19 move along the guide slot, the pistons 8 to 13 sweeping up and down the cylinders 2 to 7 as the pin members 14 to 19 move along the guide slot.

The mechanism shown in Fig. 1 forms a part of a heat engine in which the pistons and cylinders are pistons and cylinders of the heat engine and, in operation, generate motive power for the mechanism.

The details of the heat engine are not shown in Fig. 1

The energy generated in the cylinders 2 to 7 and pistons 8 to 13 as cylinders and pistons of the heat engine, causing the pistons 8 to 13 to reciprocate in the cylinders 2 to 7, is translated into rotary motion of the piston-and-rotor assembly a s a result of the pin members 14 to 19 moving along the guide slot shown in Fig. 1 and the second guide slot which is not shown. Poppet valves are included in the heads of the cylinders 2 to 7 and are controlled by static cams which are adjustable in order to vary the lift and dwell, thereby altering the performance of the heat engine. Co-operating cams are housed in a static part of the heat engine housing and a valve lifting mechanism may be included in the event that it is deemed necessary. In the case of a Diesel-cycle heat engine, an additional cam is added in order to operate an injection

pump on the cylinder head or electrically operated injectors may be provided.

The operating gas for the heat engine enters by way of the centre of the shaft 23 and is transferred to the heads of the cylinders 2 to 7 by way of radial ports. The gas charges are compressed in the ports as a result of acceleration due to the rotary motion of the piston-and-cylinder assembly, giving an added benefit of pre-compression and added density within the combustion chamber controlled by the inlet valve.

An exhaust port is controlled by an exhaust valve and exhaust gases leave the heat engine by way of a radial gallery on the side of the heat engine. Engine lubrication is effected by a pressurised oil system and cooling is effected by a radiator. Rotation is counter-clockwise as viewed in Fig. 1.

The arrangement shown in Fig. 1 is ideal as regards balance since the opposed-piston configuration provides good counterbalance. For good balance, a minimum of two cylinders is required.

Variation of the shapes of the guide slots may be used in order to vary the performance of the mechanism and a heat engine including the mechanism. Variation of the size and, consequently, the weight of the piston-and-cylinder assembly provides for different power characteristics.

There are four parts to the guide slot corresponding to the induction, compression, expansion and exhaust strokes of the operating cycle of a reciprocating heat engine and, consequently, there is ignition once per revolution. That contrasts with more conventional four-stroke arrangements in which there is ignition once every two revolutions, thus a heat engine including the mechanism produces twice as many ignition strokes as a conventional

four-stroke arrangement, leading improved power output at lower revolutions.

Referring to Fig. 2 of the accompanying drawings, a guide member 30 having a guide slot with peripheries 31, 32 accommodating four pin members 33 to 36 has a common axis 37 with a corresponding piston-and-cylinder assembly which is not shown. The corresponding piston-and-cylinder assembly has four pistons and cylinders spaced ninety degrees apart for ideal balance conditions. The operation of the mechanism of Fig. 2 is the same as the operation of the mechanism of Fig. 1 described above and the operation of a heat engine including the mechanism of Fig. 2 is the same as the operation of a heat engine as described above with reference to Fig. 1, except that a four-cylinder heat engine is expected to generate less power than a six-cylinder engine.

The guide slot shown in Fig. 2 has a rhomboid form with curved corners which are parts of ellipses. The guide slot has, in effect, four parts and those parts correspond to the four strokes of a four-stroke heat engine which provide the induction, compression, expansion and exhaust phases of operation. There are alternative shapes for the guide slot. For example, the guide slot may be elliptical in shape or may include three parts which are elliptical and a fourth part which is substantially straight, the fourt part corresponding to the expansion phase of operation.

Referring to Fig. 3 of the accompanying drawings, a piston-and-cylinder assembly includes four cylinders spaced ninety degrees apart and one cylinder 40 includes an axial slot 42 through which a pin member 41 passes, the pin member 41 also passing through the piston which is not visible. The axial slot 42 lies on a diameter of the

cylinder 40 and facilitates the assembly of the mechanism by holding the piston in the cylinder in the absence of a guide slot for performing that function. The slot 42 is longer than the stroke of the piston as set by the guide slot and, consequently, the slot 42 does not influence the operation of the mechanism.

Referring to Fig. 4 of the accompanying drawings, the pin member 41 of Fig. 3 protrudes both forward and backwards for engagement with front and rear guide slots (not shown) as does a further pin member 51. Valve members 52 and 53 are also shown in Fig. 4.

The pistons of the arrangements described above may be stepped in diameter, having the smaller or smallest diameter at the position at which the pin member is accommodated.

A basic mechanism in accordance with the invention requires one piston and one cylinder with a pin member in engagement with one guide slot and, as is indicated in relation to Fig. 3, an axial slot in the cylinder is not essential to the operation of the mechanism although a slot in the cylinder facilitates assembly.

The basic mechanism is operable as a part of a heat engine, but if driven, is operable as a pump. Diesel-cycle and Otto-cycle heat engines are suitable and steam engines are also suitable.

Further, either the piston-and-cylinder assembly or the guide member providing the guide slot may be rotatable or both may be rotatable to provide counter-rotating output shafts.

As is made clear above, balanced arrangements based on evenly spaced opposed cylinders are preferred and rotation of the piston-and-cylinder assembly is preferred.

The axial slots in the cylinders could lie on a chord of the cylinder instead of a diameter of the cylinder but the position on the diameter leads to better balance.

CLAIMS

1. A mechanism including:

a piston-and-cylinder assembly including a piston housed in a cylinder,

a pin member passing through the piston and

a guide member having a guide slot accommodating an end of the pin member,

the guide slot being so shaped and orientated in relation to the piston-and-cylinder assembly that a common axis exists between the guide slot and the piston-and-cylinder assembly,

the guide member and the piston-and-cylinder assembly being so mounted as to be rotatable relative to each other about the common axis and

the guide slot being so shaped as to guide the pin member in a continuous curve, causing the piston to sweep up and down the cylinder, when the guide member and the piston-and-cylinder assembly rotate relative to each other.

2. A mechanism as claimed in claim 1, including axial slots in the cylinder, the pin member engaging the axial slots.

3. A mechanism as claimed in claim 2, wherein the axial slots lie on a diameter
of the cylinder.

4. A mechanism including:

a piston-and-cylinder assembly including a first piston housed in a first cylinder and a second piston housed in a second cylinder,

a first pin member passing through the first piston and a second pin member passing through the second piston and

a guide member having a guide slot accommodating an end of the first pin member and an end of the second pin member,

the guide slot being so shaped and orientated in relation to the piston-and-cylinder assembly that a common axis exists between the guide slot and the piston-and-cylinder assembly,

the guide member and the piston-and-cylinder assembly being so mounted as to be rotatable relative to each other about the common axis and

the guide slot being so shaped as to guide the pin members in a continuous curve, causing the first and second piston to sweep up and down the cylinder, when the guide member and the piston-and-cylinder assembly rotate relative to each other.

5. A mechanism as claimed in claim 4, wherein the form of the piston-and-cylinder assembly permits the first and second cylinders to lie diametrically opposed to each other.

6. A mechanism as claimed in claim 5, including at least one further pair of diametrically opposed cylinders on the piston-and-cylinder assembly,

further pistons in the further cylinders and

further pin members passing through the pistons and being accommodated in the guide slot.

7 A mechanism as claimed in any one of claims 1 to 6, wherein the guide slot is of a rhomboid shape with curved corners.

8. A mechanism as claimed in claim 7, wherein the curved corners are parts of ellipses.

9. A mechanism as claimed in any one of claims 1 to 6, wherein the guide slot is elliptical in shape.

10. A mechanism as claimed in any one of claims 1 to 6, wherein the guide slot includes three parts which are elliptical in shape and a fourth part which is substantially straight, the straight part occupying a position corresponding to the expansion stroke of the piston or pistons.

11. A mechanism as claimed in any one of claims 1 to 10, including a second guide member having a second guide slot accommodating the other end of the pin member or the other ends of the pin members, the second guide slot being so shaped and orientated in relation to the piston-and-cylinder assembly as to share the common axis existing between the first guide slot and the piston-and-cylinder assembly

12. A mechanism as claimed in any one of claims 4 to 6 and claims 7 to 11 when appended to any one of claims 4 to 6 , including axial slots in the cylinders, the pin members engaging the axial slots.

13. A mechanism as claimed in claim 12, wherein the axial slots lie on diameters

of the cylinders.

14. A mechanism as claimed in any one of claims 1 to 13, wherein common axis is the axis of a shaft on which the piston-and-cylinder assembly is rotatably mounted, the remainder of the mechanism being fixed.

15. A mechanism as claimed in any one of claims 1 to 13, wherein the common axis is the axis of a shaft on which the guide member is rotatably mounted or the guide members are rotatably mounted, the piston-and-cylinder assembly being fixed.

16. A mechanism as claimed in any one of claims 1 to 13, wherein the common axis is the axis of a shaft on which the guide member is or the guide members are rotatably mounted and the piston-and-cylinder assembly is rotatably mounted on the shaft.

17. A mechanism substantially as herein described with reference to and as shown in the accompanying drawings.

18. A heat engine including a mechanism as claimed in any one of claims 1 to 17, wherein the pistons and cylinders are pistons and cylinders of the heat engine and, in operation, generate motive power for the mechanism.

19. A heat engine as claimed in claim 18, which is an internal combustion engine.

20. An engine as claimed in claim 19, which is a Diesel-cycle engine.

21. An engine as claimed in claim 17, which is an Otto-cycle engine.

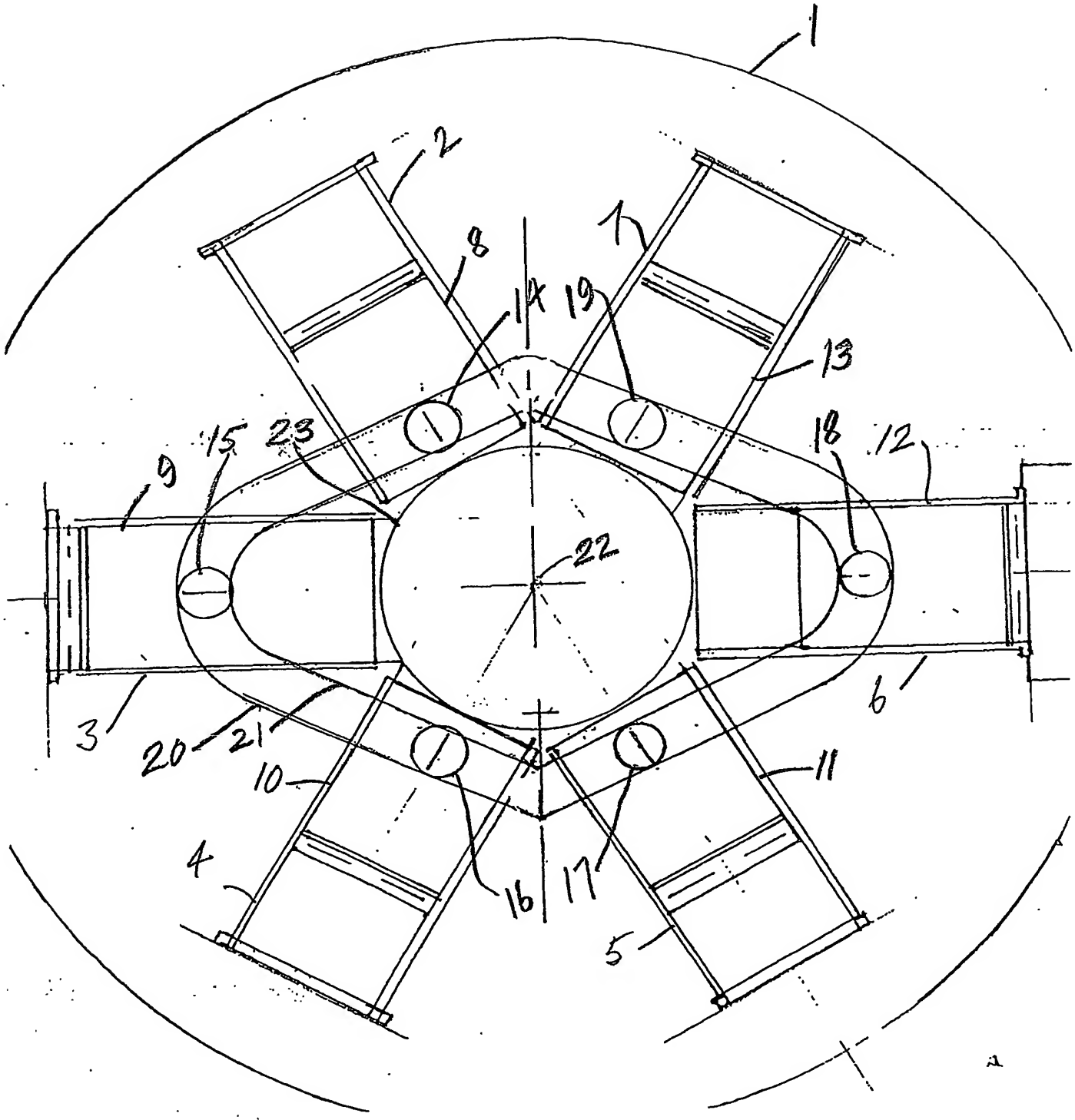
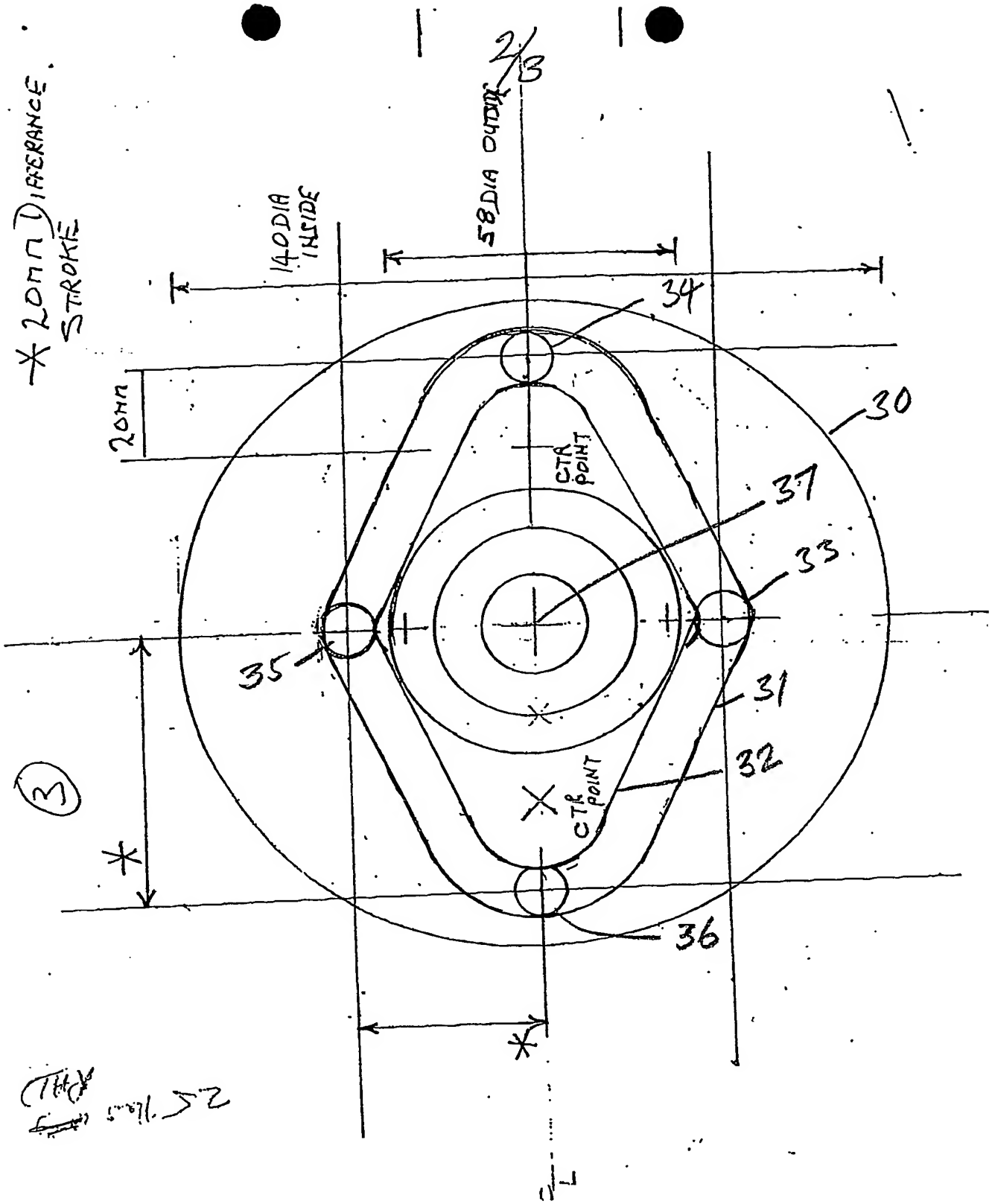


Fig 1


2/3
* 20mm DIAERANCE
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3
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Fig 2

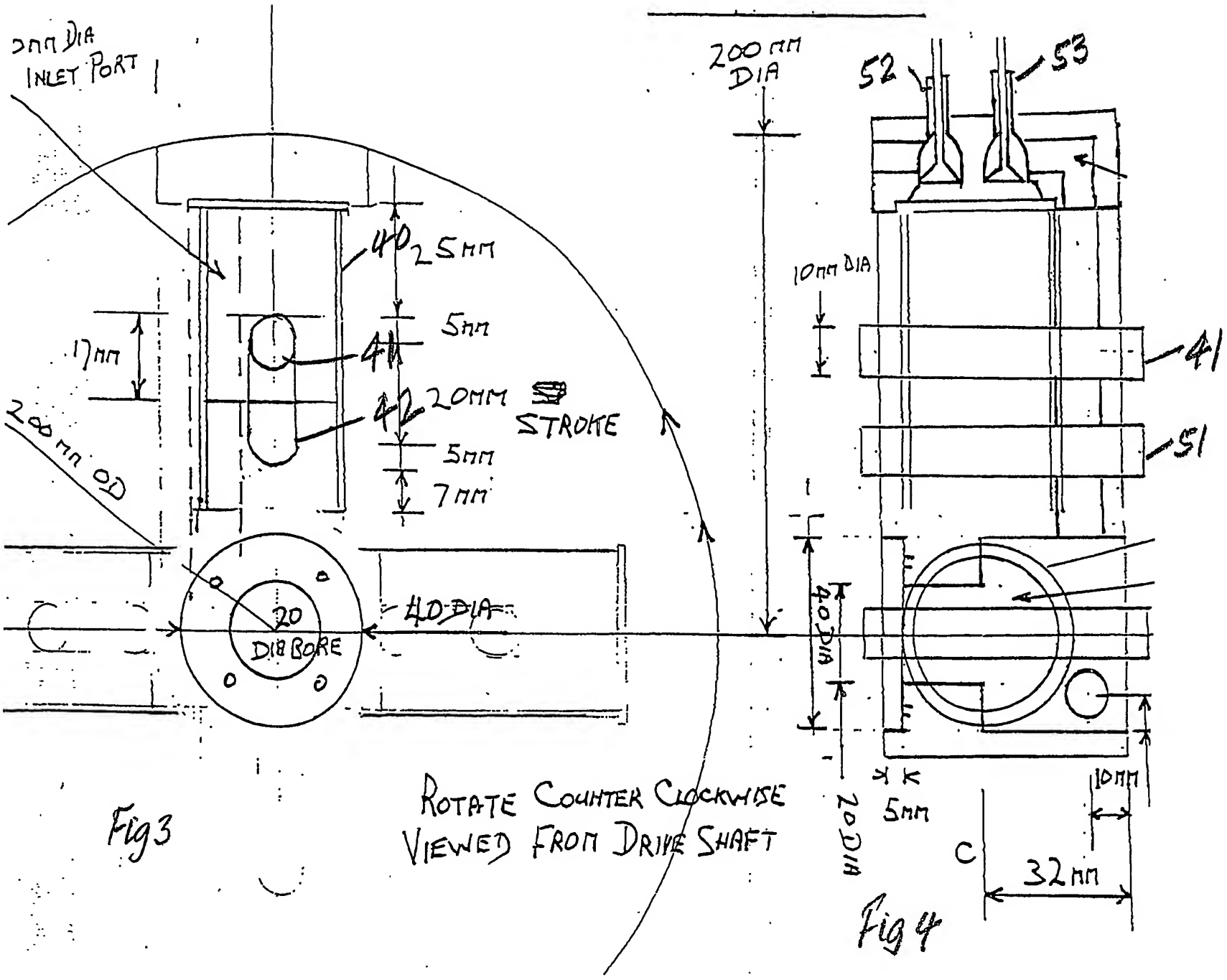

Fig 3

ROTATE COUNTER CLOCKWISE
VIEWED FROM DRIVE SHAFT

Fig 4